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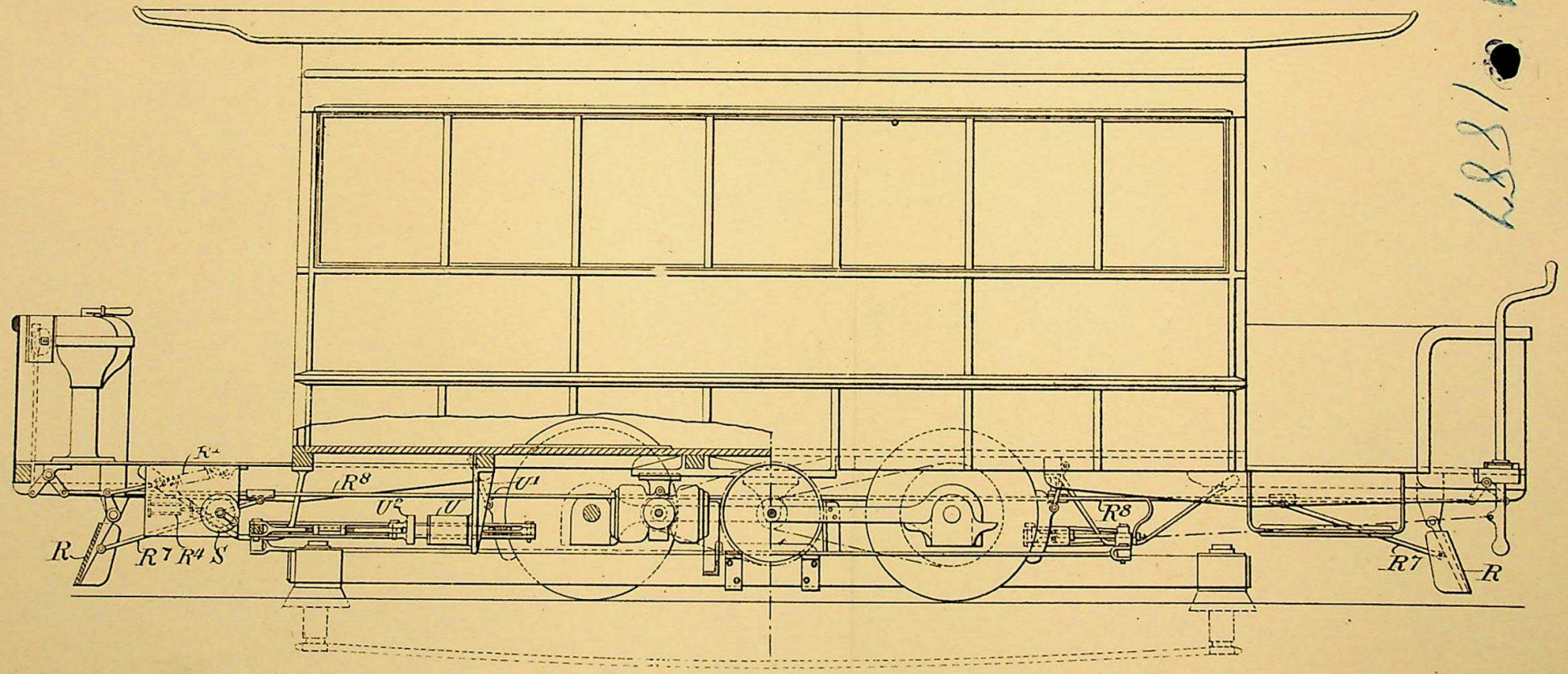
Locomotives,
Electric



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8380 OF 1887
Locomotives,
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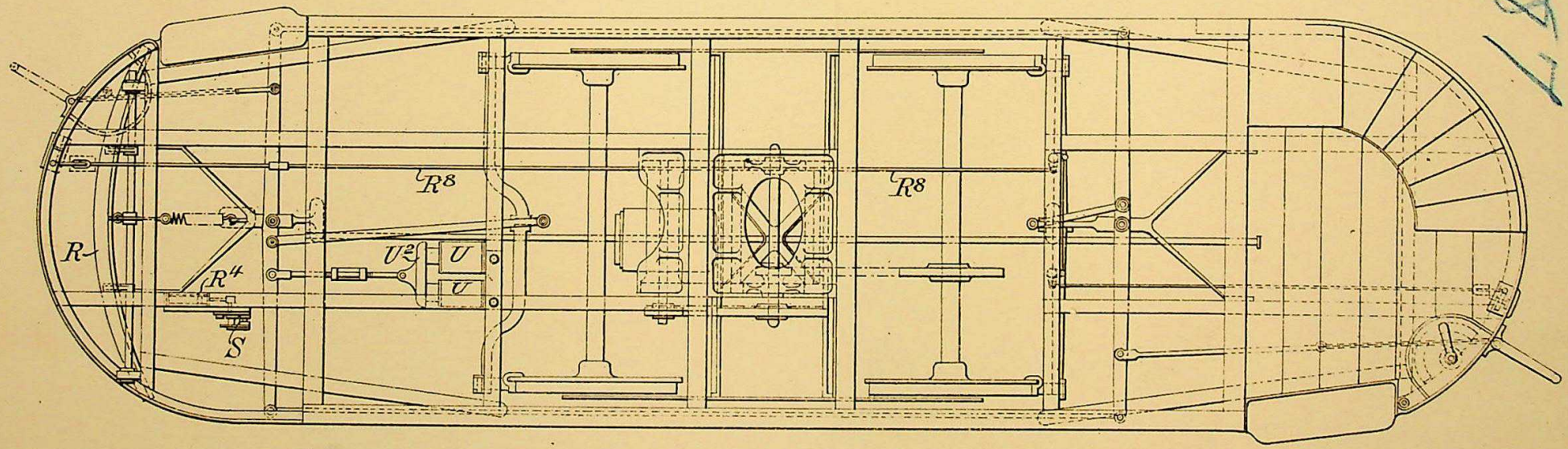

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Fig: 5.

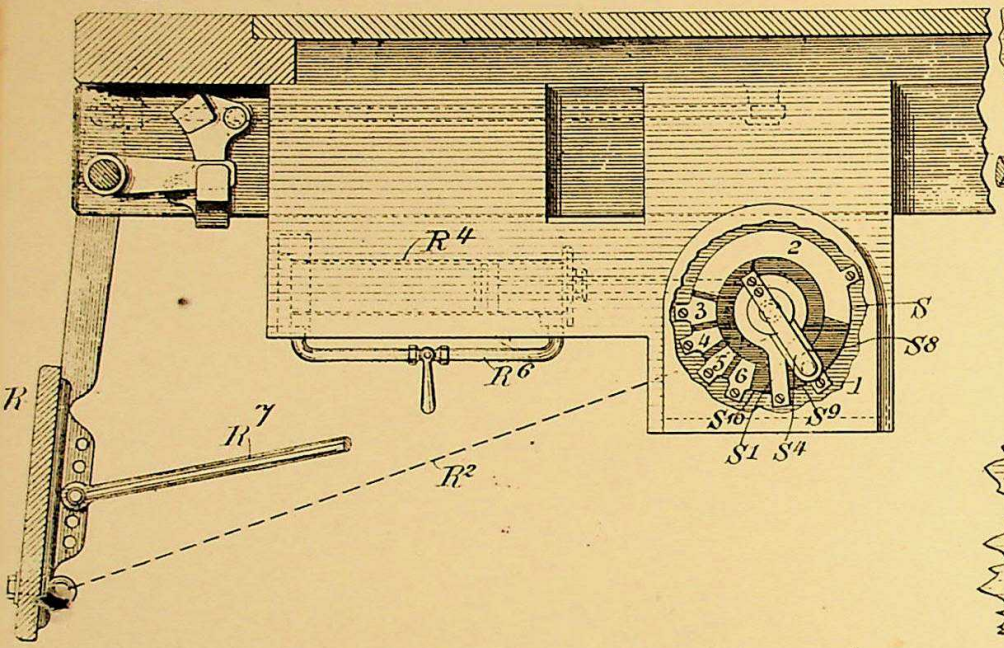
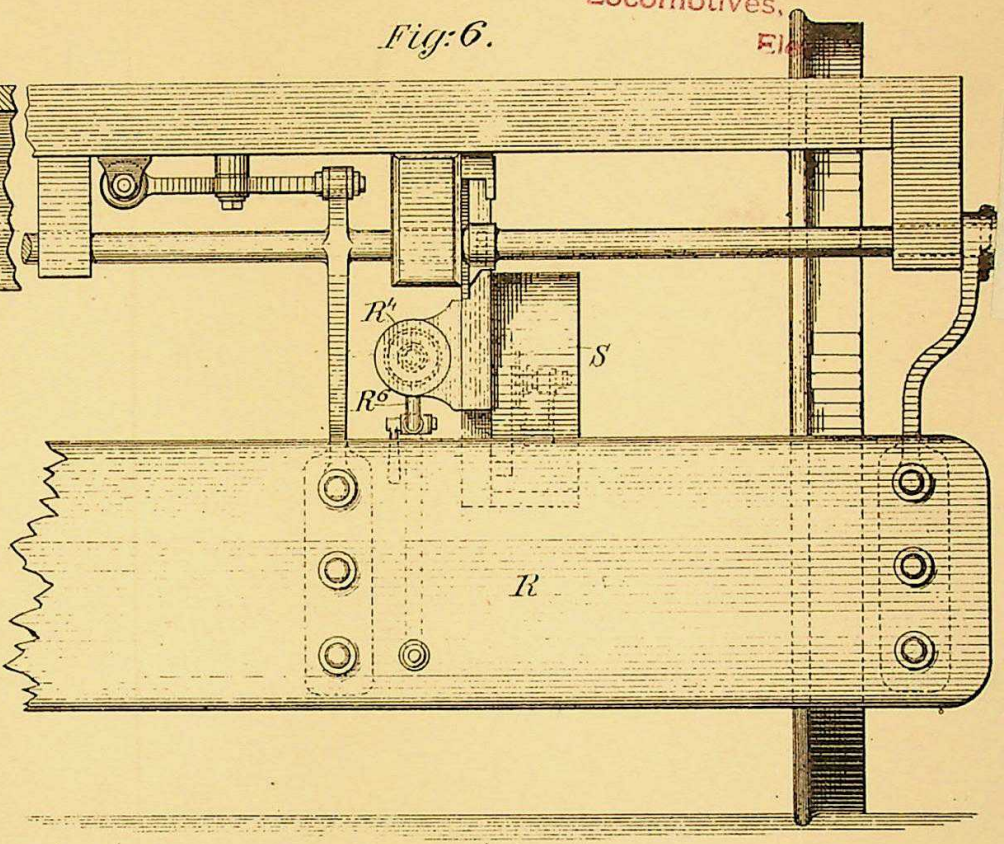


Fig: 6.



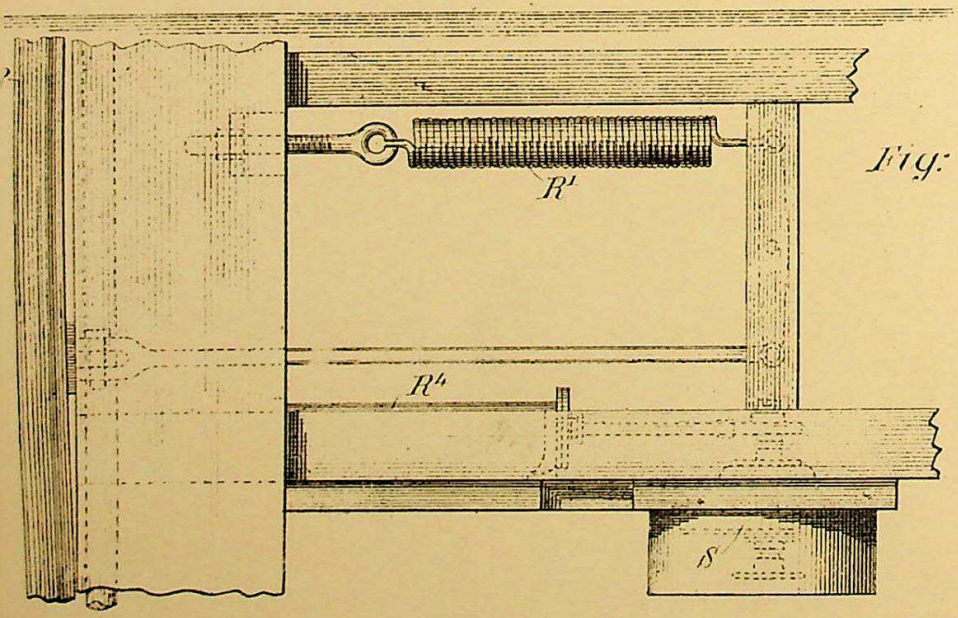


Fig: 7.

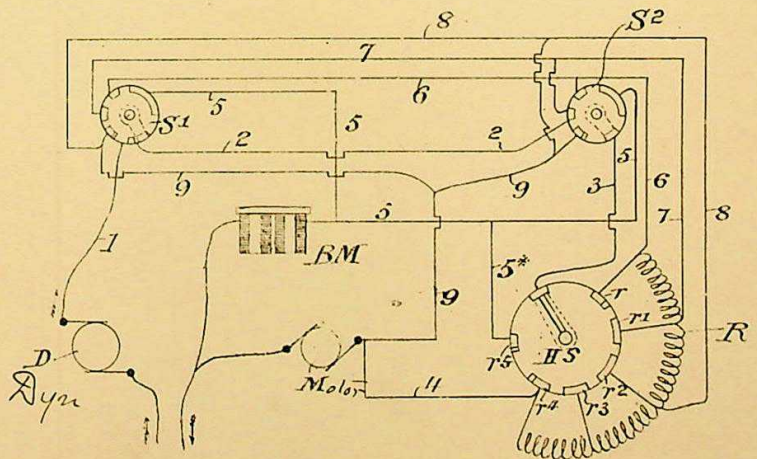


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Fig: 8.

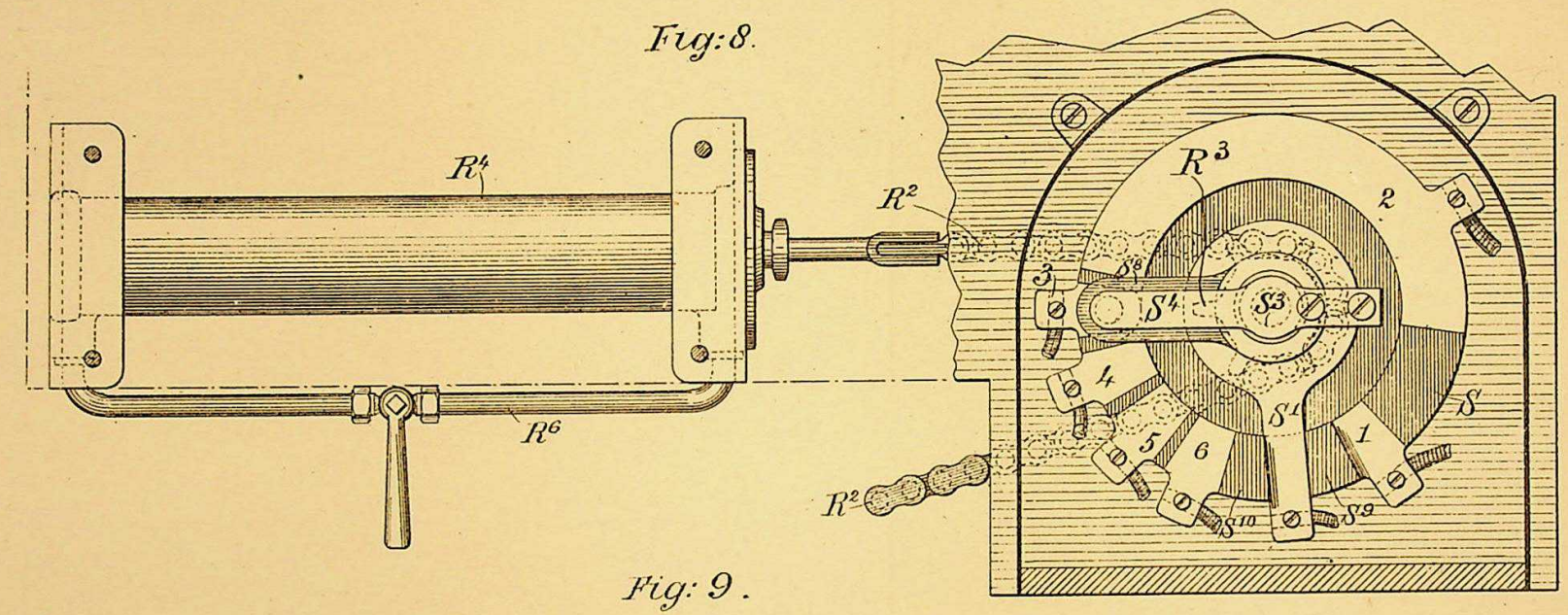
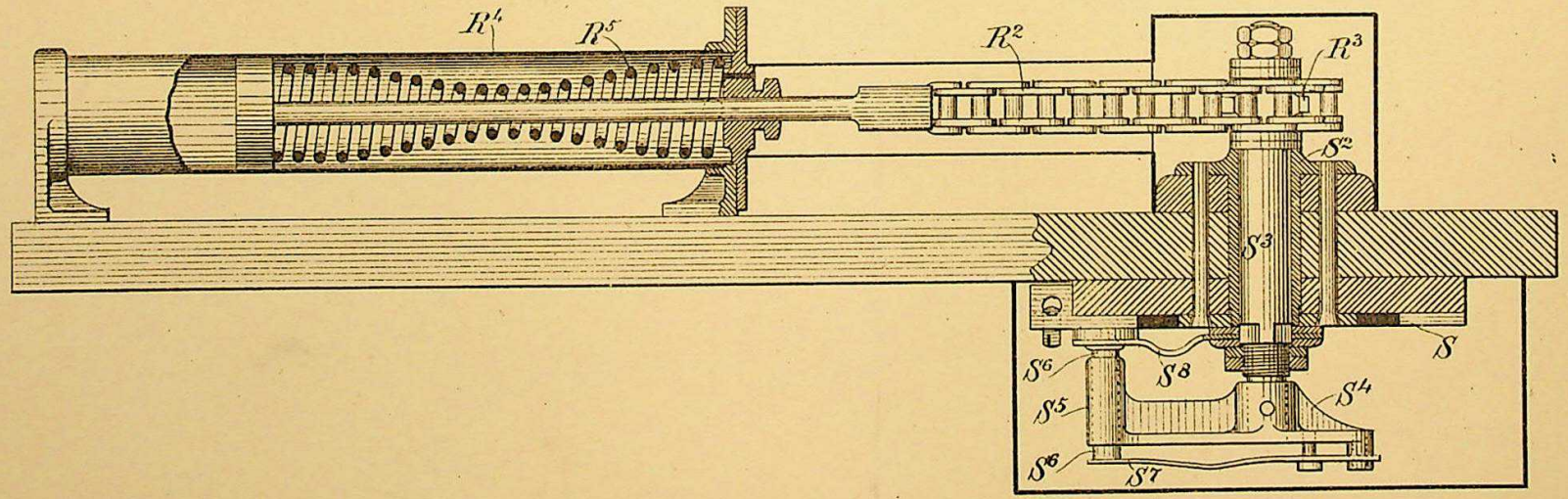


Fig: 9.



PHOTOGRAPHS
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Class 104 Electric Locomotives, Stud
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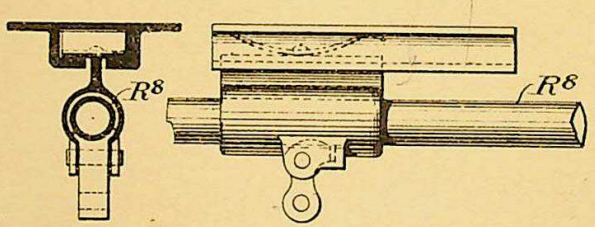
BRITISH 8380 OF 87

Fig: 11.



Figs: 12.

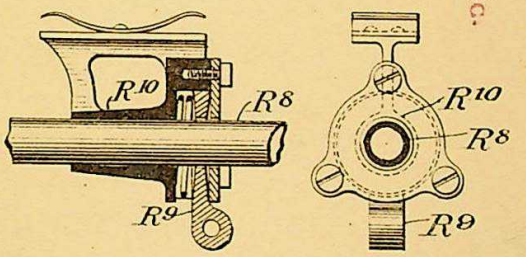
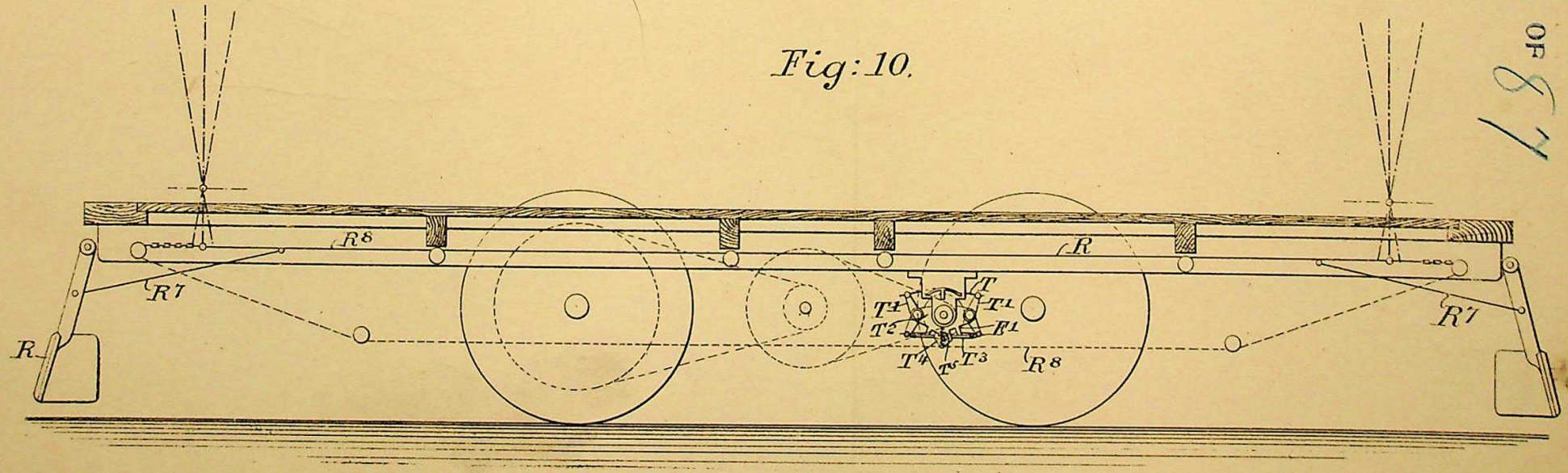


Fig: 10.



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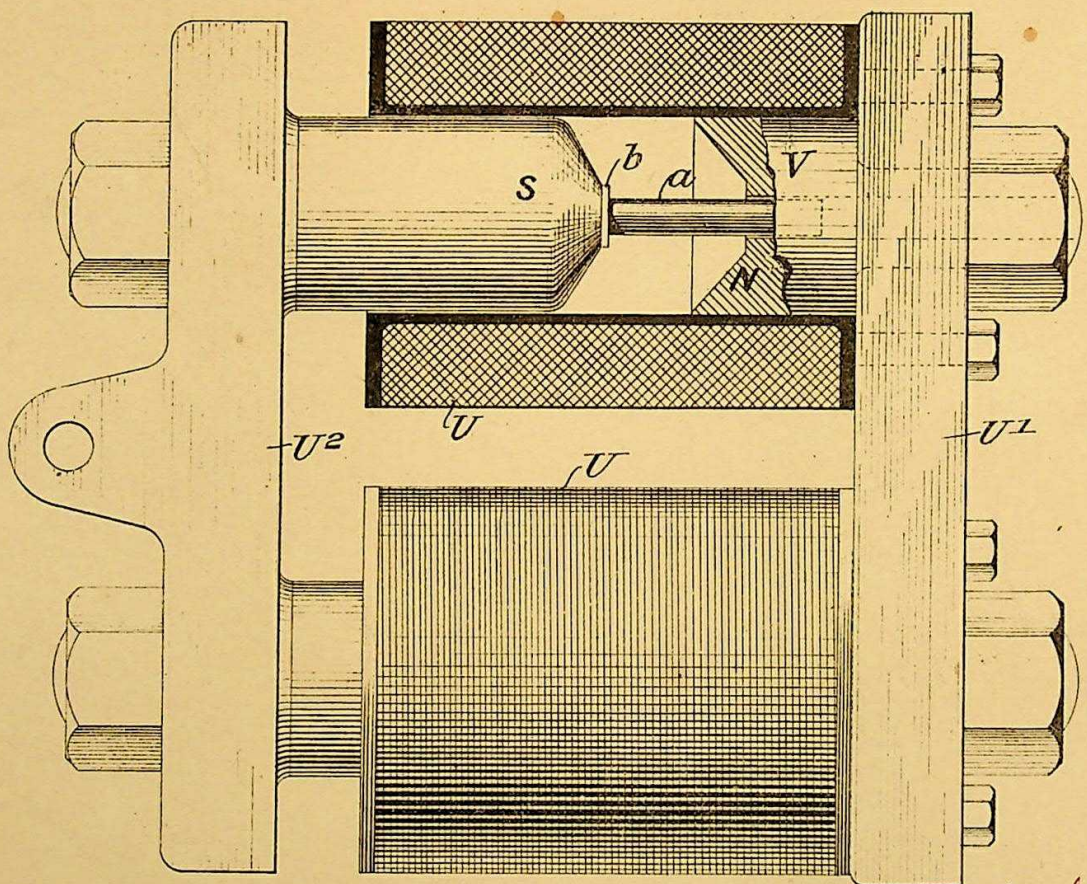

Fig: 13.

Brake mag.

Locomotive

PHOTOGRAPHS
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A.D. 1887, 10th JUNE. N° 8380.

PROVISIONAL SPECIFICATION.

Improvements in Means for Operating Tram Cars by Electricity.

We ALEXANDER LOGIN LINEFF and WILLIAM JONES both of 12, Buckingham Street, Adelphi, in the City of Westminster, Consulting Engineers and Electricians do hereby declare the nature of this invention to be as follows :—

The objects of this invention are to render the motor unaffected by the vertical movements of the car, whereby the use of flexible joints is rendered unnecessary, and the friction, and consequent loss of power in transmitting the pull of the motor to the axle of the car, is reduced, and also to provide means by which, when the car meets any obstruction, the current is automatically cut off, and is thrown into an electro-magnet actuating the car brake, the brushes being at the same time reversed, and ultimately, when the speed of the motor is sufficiently reduced, the current is put on automatically again, while the brushes are in the reversed position, and the car can thus be moved backwards until the obstacle in the road is cleared.

In carrying out our invention, we mount the motor in a suitable frame, one end of which is carried by the car axle, and the other end is supported by a link, or springs, from the underside of the car floor.

The end of this frame, which is carried by the car axle, is so constructed as to form a chamber in which is enclosed a worm wheel keyed upon the axle, and is provided with bearings for a prolongation of the motor spindle, on which is mounted a worm to gear with the worm wheel.

By these means, the gearing is not in any way disturbed or affected, if the outer end of the motor frame is raised or lowered.

The link or other means for supporting the outer end of the frame is preferably attached to the frame at the centre of gravity of the motor.

The worm and worm wheel chamber is intended to contain a quantity of oil or other lubricant in which the worm and the lower part of the worm wheel are immersed, thus reducing the friction to a minimum.

As the worm on the motor shaft is geared into the lower side of the worm wheel, the motor shaft is inclined, and on emerging from the chamber, passes through a gland with which the chamber is provided, and which prevents any leakage of the lubricant.

[*Price* 1*s*. 3*d*.]

The electric motor arranged in the above described manner may be provided with the usual reversing gear under the control of the driver. But in order to lessen the chances of accident on the road, through neglect or carelessness on the part of attendants, we hinge or otherwise movably secure, at each end of the car, a fender or board, which is kept in its normal position by means of a spring.—When pressed against by any obstacle on the road, the fenders swing inwards through a certain portion of an arc.—This movement of either fender is utilized to actuate a circular three-way switch at each end of the car, with which the fender is connected by means of a chain or rope passing round a pulley on the axle of the switch.

The middle (second) way contact piece occupies the greater part of the circumference of the switch, the two remaining ways (first and third) consisting of narrow contact pieces.

When the fender is in its normal position, the current on its way to the motor passes through the above mentioned switches, entering through the centre of the first switch to the first contact piece, thence through the centre of the second switch and its first contact piece to the motor; thus both the switches are electrically in series.

The second (wide) contact piece of each switch is in connection with the Brake magnet, and the third in direct connection with the motor. When the switch arm of either of the switches leaves the first contact piece, the motor is cut out; when it begins to travel over the second (wide) piece, the current is thrown into the brake magnet, and both car and motor slacken speed. As it is important to do this effectually before reversing the current in the motor, the other end of the chain or rope attached to the fender, and which actuates the switch, is connected with the piston of a pneumatic or hydraulic cylinder, the contents of which can be regulated in their escape (under the pressure of a spring at the back of the piston, or in any other convenient manner) by means of a cock or valve.—Thus the time occupied by the switch arm in passing over the second contact piece can be regulated at will.—In some cases we prefer to make the third way of the automatic switch of two or more separate pieces electrically connected to each other by suitable resistances. Thus, when the switch arm leaves the second way and slowly passes over the several contact pieces of the third, the current, before it reaches the motor, has to pass through a series of resistances, which are gradually cut out until the last contact piece of the series is reached, when the full power of the current is thrown into the motor.

The fender, while swinging on the hinge and actuating the switch, also reverses the brushes of the motor.—This is effected by means of a sleeve sliding on a rod flexibly connected to the lever actuating the brushes, and fitted with a suitable gripping mechanism which is connected by a strut to the fender.—When the fender moves inward, the strut presses the gripping mechanism against the rod, and thus jams it against the sleeve, whereby the rod is pushed forward and actuates the brushes.

When the switch arm comes to touch the third contact piece, the reversing of the brushes is already accomplished, and the current passes through the motor in an opposite direction to that in which it was passing when the car was moving forward.

When the obstruction has been removed, the switch and the other parts will be returned automatically to their normal position by the fender spring, and the backward motion of the car will be stopped by the driver reversing the brushes. A bridge piece may also be provided to keep the current from the brake magnet while the hand of the automatic switch above described is travelling backwards over the second (wide) contact piece, or the current may be split between the brake magnet and the motor; the latter being of comparatively lower resistance, takes the larger part of the current, while the brake magnet actuates the brake blocks only feebly.—In some cases we may insert between the third contact piece and the motor a suitable resistance,

and thus regulate the current while the automatic backward motion of the motor is going on.

Reversing as well as brake mechanism capable of being operated by hand may also be provided, such mechanism being of the usual construction. Of course, both actions (automatic and by hand) of brake, and reversing of the motor, are quite independent of each other.

Dated this 10th day of June 1887.

NEWTON & SON,
Agents for the Applicants.

COMPLETE SPECIFICATION.

Improvements in Means for Operating Tramcars by Electricity.

We ALEXANDER LOGIN LINEFF and WILLIAM JONES, both of 12 Buckingham Street, Adelphi in the City of Westminster, Consulting Engineers and Electricians, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement :—

The objects of this invention are to render the motor unaffected by the vertical movements of the car, whereby the use of flexible joints is rendered unnecessary, and the friction, and consequent loss of power, in transmitting the pull of the motor to the axle of the car, is reduced ; and also to provide means by which, when the car meets any obstruction, the current is automatically cut off, and is thrown into an electro magnet actuating the car brake, the brushes being at the same time reversed, and ultimately, when the speed of the motor is sufficiently reduced, the current is put on automatically again while the brushes are in the reversed position, and the car can thus be moved backwards until the obstacle in the road is cleared.

In the accompanying drawings :—

Fig. 1, Sheet I, shows in side elevation, and on an enlarged scale, the arrangement of the worm gearing which we use in carrying out our invention.

Fig. 2 is a plan view of the same.

Fig. 3 is a longitudinal section showing a mode of mounting the worm spindle, and

Figs. 4 show a slight modification of the same.

In Sheets II, III, and IV, we have shown the means we employ for arresting the motion of the car in case of meeting with an obstruction on the line, Fig. 5, Sheet II, being a side elevation, partly in section, of a portion of a car, with the apparatus in position ; Fig. 6 a partial front view ; Fig. 7 a partial plan view of the same.—

Fig. 8, Sheet III, is a side elevation of the pneumatic apparatus and switch detached, and Fig. 9 is a plan view, partly in section, of the same.—Fig. 10, Sheet IV, is a diagram showing a mode of changing the brushes of a motor of any suitable construction, and mounted transversely of the car.—Figs. 11 and Figs. 12, Sheet IV, show modifications in the arrangements of gripping mechanism, and Fig. 13, Sheet V, shows an arrangement of brake magnet in side elevation, partly in section. This part of the invention can be applied to the cars of any other system of electrical driving.

Referring now to Sheet I, A is the frame of the car, and B the wheel axle, the periphery of the wheel being shown by the dotted line. C is a metal framework, one end of which is supported at C^1 from the frame A.—The other end of the frame C is pendent from the axle B, and is constructed so as to form a chamber or casing C^2, within which works a worm wheel D and worm D^1, the worm wheel D being keyed on the axle B. Mounted in bearings in the frame, is a spindle or axle E, upon which are mounted a commutator or commutators E^1, and an armature of an electro-motor, of which E^2 are the field magnets.—The lower end of this spindle projects into the casing C^2, and carries the worm D^1 (see Figs. 3 and 4). A thrust block or device D^2 is provided to take up the thrust arising from the working of the worm, and this device may consist of a series of annular grooves in the casing, and a series of half rings placed round the spindle between collars, as shown at Fig. 3; or in place of the half rings, we may use rings of the shape shown at Figs. 4, which will be placed in pairs on opposite sides of the spindle, so that they will cross one another, and thus form a complete ring, which will have more even bearing surface than two half rings. These rings can readily be removed when worn, and replaced with new rings, by removing the lower part of the casing C^2.—The casing C^2 is kept full of oil or other suitable lubricant, and thus the worm and wheel will rotate in the lubricant, and the friction will be reduced to a minimum.

The gearing in the above described arrangement will not in any way be disturbed or affected, as the outer end of the motor frame C is raised or lowered, by the movement or jolting of the car.

The electric motor will be provided with the usual starting, stopping, and reversing gear under the control of the driver. But in order to lessen the chances of accident on the road through neglect or carelessness on the part of the attendants, we hinge or otherwise moveably secure, at each end of the car, a fender or board, which is kept in its normal position by means of a spring, and when pressed against by an obstacle on the road, the fenders swing inwards through a certain portion of an arc. This movement of either fender is utilized to actuate a switch at each end of the car, by means of a chain or rope passing from the fender round a pulley on the axle of the switch to a pneumatic apparatus, to cut off the current, throw it into a brake magnet, and then gradually to put on the current again, the brushes of the motor having meantime been reversed also by the movement of the fender.

In Sheets II and III, we have shown our arrangement of automatic apparatus which comes into operation when the tramcars meet any obstruction on the road.

R is a fender or board, which is hinged or otherwise moveably secured at each end to, and transversely of the frame of the car, so as to be near the ground. This fender or board, as shown in the figures, is secured to arms which are pivotted to the car frame, and it is kept in its normal position by means of springs R^1 secured at one end to the frame of the car, and at the other to projections of the arms above the pivot or hinge, either direct or through an arrangement of rods and levers, as shown at Figs. 6 and 7.

A chain, band, or rope R^2, which passes round a chain wheel or pulley R^3 (Fig. 9) on the axle of a switch S, is connected at one end to the fender R, and at its other end to the piston rod of a pneumatic apparatus R^4, suitably carried by the car frame. This apparatus consists of a cylinder R^4 (see the detail views Figs. 8 and 9) containing a piston, on the rod of which, inside the cylinder, is mounted a coiled spring R^5, the tendency of which is to drive the piston forward as soon as the tension of the spring R^1 is overcome by an obstacle in the road forcing back the fender and slackening the

chain R^2.—The opposite ends of the cylinder are connected by the pipe R^6, which is provided with a throttle valve to regulate the flow of air from one end to the other of the cylinder, according to the speed at which it is desired the piston should move. Other means may of course be provided for regulating the escape of the air from the cylinder.—The outer end of the cylinder may be provided with a valve opening inwards, so that as the piston returns to its normal position, air may be drawn in to fill up any vacuum that may be formed, and the inner end of the cylinder may be more or less open for the exit of air, so that there shall be no unnecessary pressure on the back of the piston during its return movement.

The switch S may be said to be an ordinary switch, though certain modifications are made therein to adapt it for our purposes. Round a disc or plate of insulating material, are secured insulated contact pieces 1, 2, 3, 4, 5, 6.—A fixed arm S^1, mounted on the axle S^3 of the switch, extends beyond the periphery of the disc, and forms the road by which the current enters the switch. The axle S^3 works in a metal sleeve S^2 (see Fig. 9), and on its rear end, and insulated therefrom, the chain wheel R^3 before referred to is mounted. On the front end of this axle S^3 is mounted an arm S^4, provided at its outer end with a sleeve S^5, in which a rubber S^6 slides, pressure being applied to the rubber by a spring S^7. If desired, the rubber may press against an arm of copper S^8, also mounted on the axle S^3, and which serves to somewhat shorten the circuit.—S^9 and S^{10} are stops to arrest the movement of the switch arm S^4 on one or other of the contacts 1 or 6, as required.

The electric current will always enter the switch by the arm S^1, and under normal conditions will pass out at contact 1 to the motor. Should an obstruction take place, the switch arm S^4 will be moved off contact 1 by the pneumatic apparatus R^4 (which will cut off the current from the motor), and onto contact 2. This contact is in connection with the brake magnet, so that the current will then pass to that mechanism, and put on the brake.—As the current to the brake magnet must be maintained for some time, to allow for stopping the car, we make the contact piece 2 of considerable length, nearly half the circumference of the disc, so that as the arm S^4 is moving over the face of the switch, ample time will be allowed for the action of the brake.

The switch arm S^4 will next pass successively over contacts 3, 4, 5, and 6, between each of which a resistance is or may be placed, so that the current will pass through varying resistances to the motor on the car, and will gradually, owing to the changed position of the brushes, drive the motor and the car in the reverse direction, so as to clear the obstruction, which can then be removed. The action of the pneumatic apparatus will be somewhat slow towards the end of the stroke of the piston, and this will give ample time for the motor to be driven in the reverse direction, without unduly heating the wires.

The diagram on Sheet II shows how the several operations which take place when the tramcar meets an obstruction are effected. The entry and exit of the current is indicated by the arrows. S^1 S^2 are the automatic switches at opposite ends of the car, connected in series. R represents resistances, H S a hand switch, B M brake magnet, M motor, and D dynamo.—Under normal conditions, the current enters the wire 1, and passes through S^1, wire 2, S^2, wire 3 to H S, thence by wire 4 and M to earth. In this case, the contact arm of the H S would be over contact r^4.

If an obstruction occurs, the current passes from either S^1 or S^2 according to the direct in which the car is moving, by wire 5, to B M, and then, as the arm of switch S^1 or S^2 passes over the contacts successively through the wires 6, 7, and 8, the gradually decreasing R, and wire 4, to M. When the full power is attained, the current will pass direct from either S^1 or S^2, by lines 9, to M, and thence to earth.

The hand switch is used for starting and stopping the car under ordinary circumstances. When the handle is in the position shown in the diagram, the car is standing still, and no current passes to M. By moving the handle successively over the contacts r r^1 r^2 r^3 r^4, the current passes through R with gradually increasing force until contact r^4 is reached, when the current passes direct to M by line 4. To stop the car, the handle is moved to r^5, and the current then passes by lines 5* and 5 to B M.

We may here mention that the hand switch forms no part of the present invention.

The reversing of the brushes of the motor by the movement of the fender R is effected by means of the rod R^7 attached at one end to the fender, and carrying at the other end a lever gripping device, through which passes a cord or rod R^8 connected with the brushes of the motor, which cord or rod R^8 is gripped as the rod R^7 advances, and is drawn or pushed forwards to change the position of the brushes. This lever gripping device is indicated at Figs. 11.

In place of a lever gripping device, I may use a ring gripping device, as shown at Figs. 12.—R^9 is the ring, which is placed on the rod R^8, and inside a recess in the sleeve R^{10}, with a slight spring behind it.—This spring is formed with a lug at its lower part, to which the rod R^7 is attached. As this rod is pushed forward by the fender R, it causes the ring to cant and grip the rod R^8.

We have shown, at Fig. 10, a well known arrangement for changing the brushes for the purpose of illustrating our invention; thus the brushes T of the motor are carried at opposite ends of two bell cranks T^1 pivotted to a plate T^2 secured to the motor frame. At their lower ends, the two bell cranks are connected by the rod T^3, to which is secured the notched plate T^4. This plate is held in position by the spring T^5, and it is also connected to the rod, cord, or chain R^8. As the rod R^8 is pulled in either direction, the plate T^4 is pulled with it, which rocks the bell cranks on their pivots, and brings, say, the top right hand, and the bottom left hand brushes, into contact with the commutator.

To change the direction of the current, the rod R^8 is pulled in the opposite direction, which draws the brushes above named out of contact, and throws the other two in. The notches on the plate T^4 catch against the shoulders of the plate T^2, and are thus held in position against the jolting of the car.—When the current is to be cut off entirely, the plate T^4 is brought to a central position, in which case none of the brushes touch.

In some cases, we may dispense with the automatic reversing of the motor, the action of the fender being limited to simply put the brake on, and when the car is thus arrested, the obstacle is removed, which brings the fender to its normal position. In such case, the gripping arrangement and the pneumatic device become unnecessary, the fender actuating a modified two-way switch by means of a lever or levers and connecting rods.

In Sheet V, we have shown the form of brake magnet which we propose to use. It consists of two sucking bobbins U U, which are conveniently secured to the frame or bracket U^1, and a horse shoe magnet or armature U^2, the two arms of which enter the bobbins. The ends of these arms are rounded off so as to make the magnetic action equal through the whole length of the stroke. They are each provided with a non-magnetic guide *a* to keep the cores of the armature central of the bobbins, and a similar washer *b* to prevent the opposite poles touching one another.

The frame or bracket U^1 carries two pieces of metal V, which project into the bobbins about one third of their length.—These pieces are cup shaped at their upper ends, to correspond to the cores of the armature, and they are drilled centrally right through to receive the guides *a*.

The armature is connected with a lever, which is arranged to actuate the brake blocks. The electric current passes the bobbins in such a manner as to produce the polarity as marked on the figure.

In Sheets VI and VII, we have shown a general view of a tramcar, with the mechanism for stopping the car when meeting an obstruction in position, Sheet VI showing a side elevation, partly in section, and Sheet VII and underside plan view.

Having now particularly described and ascertained the nature of our said invention and in what manner the same is to be performed, we declare that what we claim is:—

1st. The arrangement of worm driving gear for electrical tramcars substantially as herein shown and described.

2nd. The means substantially as herein shown and described for arresting the motion of, and backing the car, in case of meeting with an obstruction on the track, as set forth.

3rd. In means for arresting the motion of the car, the application and use of a fender, or equivalent apparatus, in combination with a switch for diverting the electric current from the motor to a brake magnet, as described.

4th. In means for arresting the motion of the car, the combination of a fender or equivalent apparatus, a switch, and a pneumatic apparatus, substantially as described.

5th. The modified construction of switch herein described.

6th. The combination of a fender, a gripping device connected with the fender, and a rod, chain, or rope in connection with the brush, ring or carrier, as and for the purpose set forth.

7th. The construction of brake magnet substantially as described.

Dated this 12th day of March 1888.

NEWTON & SON,
Agents for the Applicants.

LONDON: Printed for Her Majesty's Stationery Office,
By DARLING AND SON, LTD.

1888.